Flight line at Dallas, Texas, where the Vought Aeronatics Company (a division of LTV Aerospace Corporation) built these US Navy A-7Es which sandwich a camouflaged US Air Force A-7D. This early-production A-7D (AF69-6238) bears the tail letters WA for the 57th Fighter Weapons Wing based at Luke AFB, Arizona. Nearest Navy Corsair II, with temporary "E80" on rudder, is BuNo. 156813. Table III on page 120 details USN/USAF serial numbers. (Photo: Vought, ref. PR-9192)

LTV (Vought) A-7A/E Corsair II

by David A. Anderton, B. of Ae.E., A.F.A.I.A.A.

THE Vought A-7 Corsair II is, simply, a remarkable aircraft.

In its primary attack rôle, the A-7 can carry more than 15,000 pounds of bombs—three times the load of the American heavyweights of World War Two, and as much as was routinely carried by the Avro Lancaster.

The Corsair II has an unrefuelled range of nearly 2,600 nautical miles (approximately 3,000 statute miles), demonstrated repeatedly and publicly.

One such flight was made from Naval Air Station (NAS) Patuxent River, Maryland, to Evreux, France, about 50 miles northwest of Paris, non-stop and non-refuelled over a distance of 3,327 nautical miles. Pilots for the two A-7As that made the flight were Navy Commander Charles Fritz and Marine Captain Alec Gillespie. This flight was made May 19, 1967, for participation in the *Salon International de l'Aéronautique et de l'Espace*.

Developed and deployed in a notably short time, the A-7 completed its first battle tour without a single operational accident in more than 4,000 hours of combat flying during the worst months of the Vietnamese weather.

The U.S. Navy, prime user and buyer of the A-7 series, is lavish in its praise of the aircraft, both for its easy maintenance and ready availability, and also for its outstanding capabilities and performance in the attack rôle.

The U.S. Air Force, which deploys the A-7 in tactical fighter squadrons, has also found the Corsair II to be adaptable as a highly manoeuvrable low-altitude fighter.

What it's all about. Stores display on one of the original-contract Navy A-7A Corsair IIs includes (outwards) AIM-9 Sidewinder, AGM-12B Bullpup B, Mk. 1 Walleye TV-guided glide-bomb and AGM-45 Shrike anti-radiation missile. (Photo: US Navy via Vought PR-8315)

NK for CVW-14 or Carrier Air Wing fourteen. Three A-7As (nearest is BuNo. 154344) of Attack Squadron Twenty-Seven in summer of 1968 when about to be deployed on USS Constellation *with sister VA-97. Photographed at Naval Air Station Fallon, Nevada, outward bound on bomb-practice mission* (Photo: Vought PR-8566)

In that rôle, it has about three times the full-throttle endurance of the McDonnell Douglas F-4 Phantom, the fighter mainstay of both the USN and the USAF.

OUT OF SEVEN—FIVE VARIANTS

The Vought A-7 series is a single-place, single-turbojet attack aircraft, resembling the company's earlier F-8 Crusader fighters. Its compact dimensions and hulking lines have earned it an Air Force nickname of "Sluf", which—politely translated—stands for "Short, little, ugly fella".

The current A-7 series extends through the A-7G model, but only five of the seven variants have yet reached production.

A-7A (199 built). First of the production aircraft, the A-7A was powered by a Pratt & Whitney TF30-P-6 turbofan engine rated at 11,350 pounds of thrust under sea-level static conditions. Empty weight was guaranteed at 15,037 pounds, and the ordnance capacity is 15,000 pounds.

A-7B (196 built). Powered by the higher-thrust Pratt & Whitney TF30-P-8 turbofan, rated at 12,200 pounds of thrust, the B model had no other major changes from the A series.

NH for CVW-11 aboard USS Kitty Hawk *circa 1969. An A-7A (BuNo. 153207) of VA-37 with blue-painted nose radome and tips to wings and fin. Interdiction mission over Laos with Bullpup B VT-fused missiles and 500-lb. Mk. 82 Snakeye bombs.*
(Photo: US Navy via Vought PR-9035)

A-7C (67 built). The first 67 A-7Es were powered by TF-30-P-8 turbofans. To differentiate these from later E models powered by the Allison TF41, this batch has been redesignated A-7C by the Navy. Earlier, the A-7C designation was given to a design for a two-seat version of the basic A-7B. The Navy loaned one aircraft to Vought for the conversion.*

A-7D (182 built through December 31, 1971). This version, developed for the USAF, represents a major change in powerplant and systems contained within the standard airframe. The powerplant is the Allison TF-41-A-1 turbofan, an engine developed jointly by that company and Rolls-Royce Ltd. from the RB.168-62 Spey 25. Thrust rating is 14,500 pounds. Installation of a single General Electric M61A1 Vulcan—a six-barrelled Gatling-type 20-mm. cannon—was also specified by the USAF, as was the inclusion of advanced avionics with an HUD, or head-up display. The design empty weight was increased to 19,258 pounds. Production rate was nine A-7Ds per month in early 1972.

A-7E (344 built through December 31, 1972). The Navy equivalent of the D model uses most of the Air Force changes and improvements over the A-7A/B series. Powerplant is the Allison TF41-A-2, rated at 15,000 pounds of thrust. Empty weight is 18,546 pounds. Production schedule for the A-7E calls for two aircraft per month for the first six months of 1972 and three per month for the remainder of the calendar year.

KA-7F (none built). This was a proposal aircraft, intended as a carrier-based aerial tanker aircraft to replace the Douglas KA-3B Skywarrior.

A-7G (none built). This version, developed to the requirements of the Swiss Air Force, is based on the A-7D. A standard D was modified, temporarily, to pose for photographs as an A-7G, and was later changed back to an A-7D configuration. However, Swiss interest was renewed in April 1972 as detailed in the A-7G photo-caption on page 118.

Night Attack A-7 study. Development of the series continued in a jointly-funded USN-USAF programme

*Which had not been completed at the time of writing—March 1972.

A-7A (BuNo. 153269) of VA-86 ("Sidewinders"; thus tail motif), CVW-6 of USS America *circa 1968, photographed at NAS Cecil Field, Florida; the eastern seaboard training station for Corsair IIs—NAS Lemoore, California is western seaboard counterpart.*
(Photo: US Navy via Vought PR-8516)

studying the night attack potential of an advanced A-7. New equipment installed includes low-light-level television and forward-looking infra-red (FLIR) for highly accurate detection and tracking of targets at night.

Both services are comparing the results of the programme against the performance of existing, more costly aircraft: the Navy's Grumman A-6 Intruder and the Air Force's F-111.

OUT OF LIMITED WAR—ONE

The story of the Vought Corsair II series is—in largest measure—the story of the needs of American air strike forces in limited war in Southeast Asia. The time cycles coincide; the development of the A-7 and its combat deployment match dates with the start of direct U.S. involvement in Viet Nam, and the heavy air strikes of the late 1960s and early 1970s. Early in 1972, as the war in Viet Nam was "winding down", production of the A-7E was being held at two aircraft per month, the USAF purchases had been completed, and the Corsair II seemed to be nearing the end of the line.

In 1962, the specialized conditions of the limited war in Southeast Asia were spurring revaluations of long-range plans for military aircraft. One of these, the Sea Based Air Strike Study, was begun in the Office of the Chief of Naval Operations (CNO) to look at the carrier-based attack forces structure projected for the 1965 to 1972 time period.

The U.S. Navy attack force in 1962 was built around the capabilities of the Douglas A-4 Skyhawk series, the "bantam bomber" which had been conceived in the late 1940s for delivering a single nuclear weapon at the lowest possible cost. Limited war clearly showed the need for a more-versatile aircraft, with a much greater non-nuclear capability.

Part of the CNO study was the evaluation of 27 different existing and future aircraft systems, including light, medium and heavy attack aircraft, some fighters and five proposals which, earlier, had been submitted by industry in response to a design competition for an advanced experimental naval attack aircraft (VAX).

Before the study was concluded, 144 different and complete aircraft programmes had been compared in terms of cost-effectiveness, industrial capacities, fleet requirements and other factors.

Out of that study came the requirements for the VAL design, VAL being U.S. Navy shorthand for a heavier-than-air (V), attack (A), aircraft that was also light (L). The Navy wanted a low-cost, small aircraft that could carry a large bomb load over long distances.

Having gone through a similar exercise for the VAX competition, the Navy first looked again at the 1962 entries in that competition. Design proposals had been submitted by Douglas Aircraft Company, Grumman

Veteran Corsair II squadron is VA-147 (see Table I*) with several "first". In late 1967, operating from USS* Ranger *with CVW-2 (code NE), A-7As were first to see combat over Viet Nam; later first to convert operationally to A-7Es aboard USS* America *with CVW-9 (code NG). Shown here is an A-7A (BuNo. not visible) at NAS Lemoore, Calif., during bomb-practice mission. Part 20-mm. cannon's blast tube exit is clearly visible on jet intake.*
(Photo: Vought PR-8410)

The Navy uses Replacement Air Group (RAG) concept for A-7 training with two permanent squadrons assigned task of predeployment operational training; with VA-122 at NAS Lemoore and (left) *VA-174—here an A-7A (BuNo. 153167)—at NAS Cecil Field, Fla. Both views suggest excellent pilot visibility.* (right) *From NAS Lemoore, an A-7B (154531) circa 1970, of VA-56 with CVW-2 (NE) heads over southern California for the bombing range.*
(Photos: US Navy via Vought; A-7B:PR-8965)

Aircraft Engineering Corporation, Ling-Temco-Vought, Inc., McDonnell Aircraft Corporation, and North American Aviation, Inc. But the Navy concluded that it would take four or five years to develop the VAX aircraft, and that probably it would cost three times as much as the aircraft they could afford.

So the Navy decided to go with the VAL approach, preferably by developing the new aircraft around an existing airframe.

The basic datum aircraft for comparison was to be the A-4E Skyhawk. The new VAL was expected to be about 25% heavier and perhaps 17% costlier. But it was to be capable of carrying twice the payload for twice the range, giving a four-fold effectiveness over the A-4E.

The VAL also was to be a subsonic aircraft. The Navy was then committed to buy a quantity of the ill-starred General Dynamics/Grumman F-111B, a costly and controversial fighter with strike capability and supersonic dash performance. But the Navy argued that subsonic speed was was desirable for the VAL. The prime requirement was to hit small targets with bombing accuracies of the order of 25 feet maximum. Either a subsonic or supersonic aircraft would have to slow to the same speed for such accurate delivery of ordnance, the Navy said, and therefore there was equal vulnerability over the target area.

The big difference was in price. After the VAX and F-111B experience, the Navy concluded that three VAL aircraft could be bought for the price of one supersonic equivalent.

PRELIMINARY DESIGN APPROACH

The Navy started its design competition in June 1963. But earlier that year, Ling-Temco-Vought's, Vought Aeronautics Division (now Vought Aeronautics Company) had begun design studies of a modified F-8 Crusader, after the company had learned that the Navy was considering a modification programme for a new light attack aircraft.

Vought's approach was different. The first step was to gather together the top leaders of the design team that had produced the F-8 and, with them as a nucleus, to form two VAL teams.

The Red team was drawn from those F-8 specialists who had later been assigned to LTV Astronautics, where they had been working on a variety of missile and space projects. Their job was to determine how competing companies would most likely modify their own aircraft to meet the Navy requirements.

The Blue team concentrated on design modifications that could be made to the F-8 Crusader, primarily from the viewpoint of maintaining commonality between the F-8 and the VAL design.

Both teams later were combined to produce the single entry that Vought management believed would not only beat out the competition, but also exceed the Navy requirements.

From the four finalists in the design competition—Douglas, Grumman, LTV and North American—the Navy chose LTV and named that company the winner of the VAL competition on February 11, 1964.

The first contract, for $24,119,698, covered initial research, development and production of the first three A-7A aircraft. An additional $105·8 million was obligated for the purchase of Lot II, which was four more development aircraft, and Lots IIIa and IIIb, which were to be 10 and 25 production aircraft respectively. Initial unit costs were around $3 million per aircraft, but the Navy, looking to continuing buys of the A-7, expected then that the unit cost would drop under $1 million near the end of production, averaging the programme cost to about $1·7 million per aircraft.

These costs did not include such government-furnished equipment as engines and electronics. The current fly-away cost for an A-7E, admittedly a more advanced and costlier aircraft than the fitst A-7A production models, is about $2·6 million.

A unique provision of the contracts with Vought detailed a collection of one-way penalty clauses, with dollar penalties placed on failures to meet the contract provisions. There was an upper limit to the total of penalties, but there were to be no bonus payments for exceeding contract requirements.

Failure to meet the weight empty guarantee, for example, could cost the company as much as $750,000. Failing to meet delivery guarantees of development aircraft would cost LTV as much as $65,000 per late day, with a maximum penalty of $1·2 million.

Performance guarantees missed would draw other

penalties up to $400,000 for deficiencies in maximum speed at sea-level, take-off and landing distances. Missing either the catapult take-off speed or the radius-of-action guarantees would cost as much as $750,000.

Additionally, tough requirements were set for maintenance and serviceability, tied to a maximum figure of 11·5 maintenance man-hours per flight hour (USN: mmh/fh; USAF: MMFH). Higher values would result in penalties up to a maximum of $700,000.

Vought met or exceeded almost every one of its guarantees; but perhaps the most noteworthy was the standard established for Navy mmh/fh. The contract guarantee was outstanding to begin with, in the context of other contemporary aircraft which require as much as four or five times that amount.

During an early public demonstration of the A-7A, Vought technicians removed the engine in less than 18 minutes, and one of the 20-mm. Mk. 12 cannon in less than 90 seconds. But the real test was to come when the Navy ran its own evaluation at NAS Cecil Field.

Six A-7As—with airframe time from nearly zero to 100 hours—and a group of pilots both new and experienced in the A-7 were assigned to the tests. The schedule required that a minimum of 600 hours and a maximum of 900 be flown during the evaluation.

But by the time that 362 sorties had logged 733 flight hours, the Navy concluded that the guarantee had been so thoroughly demonstrated that no further testing was required. The test data showed times less than 9·6 mmh/fh.

A-7Bs in tight echelon displayed by VA-93 of CVW-2 (NE), sister attack squadron to Va-56. Both flew from USS Ranger *in 1970 and a year later with USS* Midway *and CVW-5 (NF). Here the "Blue Blazers" were temporarily based for training at NAS Lemoore, Calif.*
(Photo: US Navy via Vought PR-9178)

CORSAIR II GENERAL DESCRIPTION

All models of the Corsair II share a common basic geometry, with the exception of the overall clearance length, where there are minor differences between models.

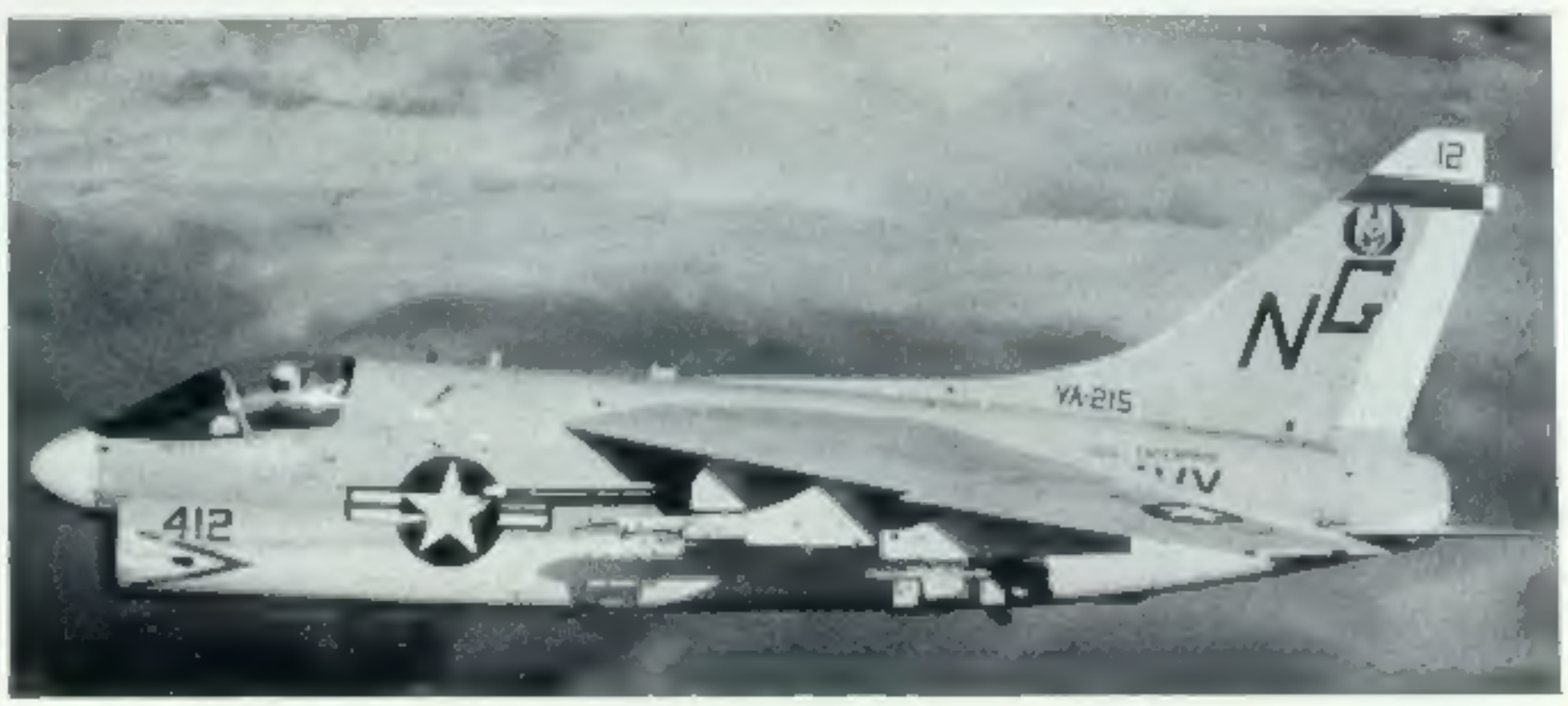
The aerodynamic heritage of the F-8 Crusader is apparent in the general layout, with its swept wing with its outboard leading-edge extension, and the "sit" of the aircraft in the air. But, beyond that, there is little shared between the two. The two-position wing of the F-8, developed for the high-lift demands of carrier landings, was dropped in favour of improved flap systems on the A-7.

The Corsair II is built around a high wing, with an area of 375 square feet. It is sweptback 35° at the quarter-chord line, and has built-in leading-edge camber. The relatively low aspect ratio of 4·0 is characteristic of current aircraft designed to operate efficiently at low altitudes. Wing thickness is a constant 7% from root to tip, and the aerofoil is an NACA 65A007 section. The wing has a negative dihedral of five degrees, and is mounted with a one-degree angle of incidence. Spread wingspan is 38·73 feet, which is reduced to a folded span of 23·77 feet.

A single-slotted trailing-edge flap spans 9·2 feet of each wing panel, and deflects variably to a maximum angle of 40° for landing. The entire leading-edge of the wing is spanned by a flap, 12% of the wing chord in depth, which deflects to a maximum angle of 42°.

Conventional ailerons are fitted, and inboard spoilers and slot-deflectors are installed on the wing forward of the flaps. Spoilers are actuated during low- and high-speed flight to increase the roll rate when ailerons tend to lose their effectiveness. The 6·24-ft. span ailerons are sealed and deflect through up and down angles of 25°. Spoilers deflect upward to a maximum angle of 60°.

The slot-deflector is under the leading-edge of the wing



An A-7B of VA-215, CVW-9 (NG), flying from USS Enterprise *1969. VA-215 subsequently joined CVW-6 (AE), USS* Roosevelt; *then CVW-19 (NM) on USS* Oriskany. *The "Barn Owls" device is on fin above NG.*
(Photo: US Navy via Vought PR-8925)

VA-215 again . . . with Sicily's Mt. Etna for thermal lift. By 1970, the "Barn Owls" A-7Bs now sport AE for CVW-6 while aboard USS Roosevelt. *Outer pylon supports "Buddy Mission" in-flight refuelling store which Douglas Aircraft (El Segundo) developed in mid-1950s.*
(Photo: US Navy via Vought PR-9374)

flap, and it opens to a maximum of 30° downward to scoop extra air into the slot between the wing and the flap. This makes the flap more effective at high deflections.

The horizontal tail is a pair of separate synchronized one-piece surfaces, spanning 18·14 feet and with 45° of sweep. They are mounted on the fuselage with a positive dihedral of five degrees 25 minutes, and can deflect 6·75° up at the leading-edge and 26·5° down.

The vertical tail spans 12·87 feet, is swept at 44·28°, and uses a sealed rudder with maximum deflections of ±24·5° for take-off and landing, and ±6° for high-speed flight and cruise.

The 25·4-sq. ft. area speed brake is mounted on the fuselage belly, and deflects variably through a maximum angle of 60°.

The fuselage has the characteristic look of its F-8 Crusader ancestor, although the rounded nose radome gives the Corsair II a more pugnacious appearance. The cockpit is well forward, giving unexcelled visibility for the primary missions.

CORSAIR II STRUCTURE AND SYSTEMS

Although the aerodynamic geometry is common to all A-7 models, the other design features are not. Structurally, the four production aircraft are very similar, with differences in local construction to accommodate the changes of later models.

In the following descriptions, significant changes among models are noted.

Structurally, the Corsair II reflects state-of-the-art methods of design and production. The basic wing is a "fail-safe" multi-celled box formed of spanwise beams and heavy upper and lower skins. The fuselage is built around continuous longerons, load redistribution bulkheads and skins, which are stiffened by frames, to carry shear loads. The load redistribution principle provides a fail-safe feature for the fuselage. Lower skins are non-structural, so that many access panels can be provided for ease of maintenance. Loads through that area are carried by the mid and lower longerons. Vertical tail construction is similar to that of the wing, with the same fail-safe design principles.

The A-7D/E structures have a design life of 4,000 flight hours and a load factor of 7 G at the design combat weight of 29,575 pounds.

Main landing gear is a tripod structure with a single wheel and brake assembly. In the A-7D, the Air Force specified a high-energy braking system, with a capacity of 11 million foot-pounds. The Navy A-7E system has a lower energy capacity of 8 million ft.-lb. Both models use an anti-skid system.

The nose gear carries its dual wheels on a single-strut assembly. The dual wheels result in better cornering and reduce the power required for taxiing. The nose gear has power steering through angles of ±61°. The Navy nose gear has a catapult hookup capability, replacing the separate catapult bridle system used on such aircraft as the F8- Crusader.

Design loads for the landing gear assume a landing weight of 32,251 pounds and a sink rate of up to 10 feet per second for field landings. The Navy carrier requirement calls for a design landing weight of 25,300 pounds and a sink rate of up to 20 feet per second. Under these conditions, an A-7D can land with up to 13,114 pounds of fuel, ordnance or both; either model can take-off at a gross weight as high as 42,000 pounds.

The Corsair II control systems are driven by irreversible hydraulic actuators in tandem pairs controlled by cable or direct mechanical linkages. Springs provide artificial feel and centring forces for the controls, and additional feel force in the longitudinal controls comes from a system of bobweights and dampers which senses both normal and angular accelerations.

The speed brake is hydraulically operated and can be extended and held in any position between its closed and open angles.

A three-axis, dual-channel autopilot system provides automatic control of flight altitude, attitude and path. On the A-7D, it includes six operational modes; on the A-7E, an additional two modes, for automatic carrier landings and ground-controlled bombing by data link, are provided.

(Right) *Impressive. Six pylons support 28 × 250-lb. Mk. 81 inert GP bombs on USAF prototype A-7D Corsair II (AF67-14582); flown by Vought Chief Experimental Test Pilot Robert Rostline.* (Photo: Vought)

(Right) *Third USAF A-7D (AF67-14584) reveals characteristic refuelling "hump" above wing root. Except for the 17th A-7D, this feature was not incorporated in production until the 27th example. Single pylons each carry 4 × 750-lb. dummy bombs for test purposes.*
(Photo: Vought PR-8878)

(Right) *Another stores' arrangement tested on the first A-7D: inboard pylons each have a single 300-US gal. drop tank and middle pylons have paired AGM-65A TV-guided missiles.*
(Photo: Vought PR-9343)

At the controls for first flight of prototype A-7D at Dallas, Texas, on April 6, 1968, John W. Konrad, Director of Flight Operations for LTV Aerospace Corporation. Blister on jet air intake is for the single 20-mm. M61 Vulcan six-barrel cannon. Aerodynamic test rig on nose cone added for critical A-7D development programme. (Photo: Vought PR-8585)

Cockpit layouts are similar for both models, but—as might be expected—the basic instrument layouts differ in detail. The cockpit has a full instrument panel forward, and a large console on each side. Navigation and flight instruments are in the centre of both the A-7D and the A-7E panels. System monitoring instruments occupy the lower right sector on the A-7D, and the lower left on the E model. Armament controls are on the lower left in both aircraft.

The left console carries the usual power controls as well as those for the landing gear, radar, communications and pilot equipment. The right console carries annunciators, and controls and indicators for hydraulics, computers, environmental and wing-folding systems.

The pilot sits on a Douglas Escapac I-C2 ejection seat, activated either by a face-curtain pull or by a D-ring between the pilot's legs. Everything that follows the initiation action is fully automatic. Safe ejection envelope covers the speed range from zero to 650 knots indicated airspeed at altitudes from sea-level through 50,000 feet. The parachute is an NB-10 model.

CORSAIRS IN MORE DETAIL

The Corsair II was designed to carry 15,000 pounds of ordnance—missiles, bombs, and other stores—and to drop them with pinpoint accuracy against ground targets. This basic requirement dictated everything that followed in the aerodynamic and structural layouts, the choice of systems, instrumentation, weaponry, armour plate, powerplant.

Given the basic mission, intangibles such as low vulnerability, high reliability and quick turnaround had to be developed in the design. Low-level flight at high speed placed stresses on the airframe quite different from those imposed by high-altitude air combat. The ability to fight its way home meant that defensive weapons would be needed.

Range and endurance demanded large quantities of internal fuel, plus the capability to carry additional drop tanks externally for long-range ferry or reconnaissance missions. Out of all these sometime-conflicting requirements came the first of the Corsair models.

The A-7A, like its later models, is capable of operating off carriers or shore bases. It is capable of high subsonic speeds and has a large radius of action.

The guaranteed empty weight was 15,037 pounds. That guarantee was missed by a few hundred pounds, which imposed a cost penalty on Vought. They accepted it on the basis that the extra weight of the structure would permit future growth potential that would turn out to be far more rewarding than the amount of the contract penalty.

On internal fuel, the A-7A has a ferry range of 2,920 nautical miles; with additional external fuel, that figure can be extended to 3,560 nmi. In-flight refuelling by the probe-and-drogue system is built in.

Fuel capacity of the A-7A is 1,500 US gallons, or about 10,200 pounds of JP-5 jet fuel; another 1,200 gallons (8,160 pounds) can be carried externally.

Catapult gross weight limit for the A-7A is 38,000 pounds, and landing design weight is 24,431 lb.

All ordnance is carried externally on six wing pylons and two fuselage side mounts. The six wing pylons can handle a wide variety of bombs, missiles, pods and tanked stores, and the fuselage pylons are used to mount two Sidewinder missiles for defence. A pair of 20-mm. Mk. 12 cannon plus more than 600 rounds of ammunition is installed in the fuselage nose. Steel armour plate protects the pilot against frontal fire, while aluminium armour protects him from below. There is space provision for armour protection in other critical areas.

Weapons delivery systems are relatively simple, being based on optical sighting tied to a computer for data and a weapons-release programmer. Radar is available for ground mapping, terrain following and terrain clearance, air-to-ground ranging, and tracking. Standard communications and navigation systems are installed.

Early models of the A lacked the electronic countermeasures antenna which protrudes aft just above the rudder. Consequently, their overall length was 46·13 feet. But after airframe change 15, which included the addition of the APS-107 ECM antenna, that clearance length was increased to 46·75 feet.

Early Navy experience with the first A-7As delivered to training squadrons led to a programme of modifications for fleet deployment, made on later production aircraft before assignment to carrier-based squadrons.

The second model in the Corsair II series, the A-7B, is essentially the same as the A except for the powerplant. The TF30-P-8, rated at 12,200 lb. of thrust, provided an extra margin of power for carrier operations, particularly during catapult launches where every ounce of thrust counts. Airframe change 184, made early in 1971, made provision for the installation of the TF30-P-408 turbofan, an uprated version of the -8 delivering 13,400 pounds of thrust.

Capabilities and performance of the A-7B are essentially identical to those of the A model.

MAJOR MODEL CHANGES

The A-7D and E series represented major design changes from the earlier aircraft.

The A-7D is powered by the TF41, which replaces the TF30 engines of the earlier models. In its nose it carries a single General Electric M61A1 Gatling-type 20-mm.

Key to colour photographs

1. **A-7B** Corsair II (BuNo. 154421), Attack Squadron Eighty-Seven (VA-87: "Golden Warriors"), of Carrier Air Wing Six (CVW-6: coded AE), August 1970.
2. **A-7E** (157455), VA-83 ("Rampagers"), CVW-17 (AA), USS *Forrestal*, 11/70.
3. **A-7E** (157446), VA-81 ("Sunliners"); as above VA-83.
4. **A-7B** (154453) VA-72 ("Blue Hawks"), CVW-1 (AB), USS *John F. Kennedy*, circa 1971.
5. **A-7E** (156803), VA-147 ("Argonauts"), CVW-9 (NG), USS *America*, c. 1970–71.
6. **A-7E** (156815), VA-146 ("Blue Diamonds"), as VA-147.
7. **A-7E** (156872), VA-97 ("War Hawks"), CVW-14 (NK), c. 1971.
8. **A-7A** (153252), VA-86 ("Sidewinders"), CVW-6 (AE), USS *America*, c. 1968.
9. **A-7B** (154462), VA-46 ("Clansmen"), as VA-72.
10. **A-7A** (153161), VA-37 ("Bulls"), CVW-3 (AC), USS *Saratoga* 5/71.
11. **A-7B** (154361), VA-174 ("Hell Razors"), RCVW-4 (AD), NAS Cecil Field, Florida.
12. **A-7E** (157544), VA-66 ("Mod Squad"), CVW-7 (AG), c. 1971.
13. **A-7B** (154509), VA-56 ("Champions"), CVW-18 (AH).
14. **A-7D** (70-1010), 357th TFS ("Licking Dragons"), (code DC), 355th TFW, Davis-Monthan AFB, Arizona.
15. **A-7D** (70-999), 354th TFS ("Fighting Bulldogs"), (DA), 355th TFW.
16. **A-7D** (68-8231), 333rd TFS ("Lancers"), (DM), 355th TFW.
17. **A-7D** Badge of the 355th TFW; on starboard side of fuselage only.

(Photos: US Navy, US Air Force via Art Schoeni of Vought and author.)

AC12/EE

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The sixth Air Force A-7D (AF68-8220) took part in Project Seek Eagle, *at Eglin AFB, near Valparaiso, Florida (Hq. of Air Proving Ground Centre and Tactical Air Warfare Centre) and is seen here with four pylons supporting 20 × Snakeye Mk. 80 retarded-fall bombs each weighing more than 300 pounds. Painted stripes are for telemetering only. The Navy arrester-hook is retained on all A-7Ds.* (Below) *Third A-7D (AF67-14584) flown by John D. Konrad, undergoing Boeing KC-135 simulated in-flight refuelling development tests. Bomb clusters add up to 12,500 pounds.*
(Photos: US Air Force via Vought)

cannon, with a rate of fire of either 4,000 or 6,000 rounds per minute selectable by the pilot, and 1,000 rounds of ammunition.

A major requirement for the A-7D was a reduction in ordnance delivery errors from 20 mil (one mil is one part in one thousand) to 10 mil.

An anti-skid brake system was developed for the D model. Additional attention to survivability led to polyurethane foam-lined fuel tanks, self-sealing fuel lines, three separate power control systems instead of two, more system redundancy and back-up controls, additional and extensive steel and boron carbide armour plate, and both passive and active electronic countermeasures equipment.

The air-to-air refuelling system was changed from the standard Navy probe-and-drogue type to the USAF's tanker boom receptacle. This change to TAC Mod. 1 configuration was made on the 17th, 27th and subsequent A-7D aircraft.

But the biggest change in the A-7D was the inclusion of the new avionics package which, in the words of one pilot, made the airplane itself a better bomb-dropper than the best pilot could. The package features a combined navigation and weapons delivery system with a head-up display and provisions for a projected map display that almost completely automated the process of flying to the target, striking it, and returning to base.

The A-7D carries approximately its own weight in fuel, distributed in six fuselage tanks and a wing tank which fills the entire centre section forward of the rear spar.

Total internal fuel capacity is 1,425 US gallons (9,263 lb. of JP-4).

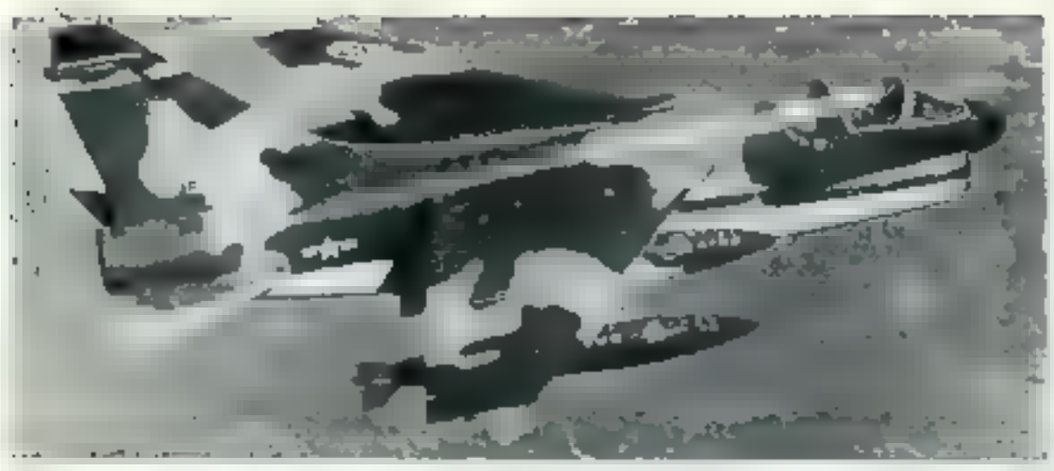
The six fuselage tanks are divided into left and right forward and mid tanks, a single aft tank and a sump tank which is the primary feed reservoir for the engine. The sump tank and the lower third of the aft tank are self-sealing; their sealed capacity holds enough fuel for a 300-nmi. range.

All fuel is fed first to the sump tank, either by gravity or by ejector pumps, with back-up systems using air bleed. There is a pressure-fuelling receptacle in the wheel well, and gravity refuelling can be done through inlets in wing and fuselage.

External fuel up to 1,200 gallons (7,800 pounds of JP-4) can be carried in four Aero 1D low-drag tanks.

All ordnance is carried externally on six mounts under the wings and two fuselage side mounts. The outboard two wing stations each have a 3,500-pound capacity, and the inboard can carry 2,500 lb. Fuselage mounts carry 500 pounds each.

The possible combinations of stores and weapon loadings are many; some of the variations are shown in the



Production A-7Ds in service. (left) *Four 300-gal. drop tanks show long-range ferrying configuration of the 30th A-7D (AF69-6200). The code letters LA signify Luke AFB, Phoenix, Arizona, when "200" was allocated to the 310th Tactical Fighter Squadron, 58th TFW; later changed to DM when serving with the 333rd TFTS, 355th TFW at Davis-Monthan AFB, Tucson, Arizona.* (right) *Also of Luke AFB, two A-7Ds (AF68-8225 and -8226) from Detachment 1, 57th Fighter Weapons Wing during Phase IB of Category III operatal testing and evaluation. In 10 months of testing more than 2,200 flying hours accrued.*
(Photos: US Air Force)

photographs, and typical loadings are detailed in Table II on page 119.

Reliability requirements stiffened for the A-7D. Measured as the percentage of successful missions completed, the A-7D reliability was specified as a minimum of 77·5%. Direct maintenance man-hours per flight hour were to be reduced to a maximum of 9·5 from the contracted 11·5 figure for the earlier A-7A/B series.

Typical performance figures for the A-7D show a 4,000-ft. take-off distance on a 60°F. day at take-off gross weight with a load of eight 750-lb. M117A1 general-purpose bombs. With that load, it will climb to cruise altitude near 30,000 feet in 15 minutes, and drift up to about 35,000 ft. as the fuel burns off. On the return flight, it will cruise from 38,000 to 43,000 ft., descend and land with a ground roll approximating 4,000 ft.

Maximum speed in level flight depends on the configuration. Clean, the A-7D can touch Mach 0·92 at about 23,000 feet. With four low-drag general-purpose bombs the speed is only reduced to Mach 0·91. With 7,500 pounds of bombs on multiple-ejection racks and triple-ejection racks, the speed is a respectable Mach 0·79.

With the latter loading, the A-7D can pull a 3·2 G turn at a speed of 400 knots at sea-level, increasing that performance to a 5 g turn at 450 knots in an essentially clean condition. Its sustained turn radius, clean, is about 3,500 feet.

Close-support mission for the A-7D is based on a take-off weight of 37,456 pounds, which includes a load of eight M117A1 bombs. At the target, the plane loiters at 241 knots and 5,000 feet altitude, fights for five minutes at sea level and maximum rated thrust, and returns to base, with a 20-minute loiter time at the destination.

Under those conditions, there is a direct and obvious relation between the radius of action and the loiter time in the target area. That time varies in a straight line from 82 minutes at a 100-nautical mile radius to zero at a 500-nmi radius. At a "typical" radius of action of 300 nmi., the time on station is about 42 minutes.

The ferry mission is based on optimum cruise conditions for maximum fuel economy. With a clean airplane, the cruise is at 494 knots and an initial cruise altitude of

Two from Myrtle Beach AFB, S.C. Starboard side only escutcheon-style shield behind cockpit proclaims the 354th TFW whose three Tac-Ftr-Sqns are the 353rd (MR, on A-7D AF69-6239), 355th (MB, on AF70-938) and 356th (MN, see colour page 112).
(Photos: USAF)


303
303
303
NH303
03
NH
NAVY
VA-192
USS KITTY HAWK
157524
303

"NH 303" is an LTV (Vought) A-7E Corsair II (Bu. No. 157524) of the US Navy's Attack Squadron One Hundred Ninety-Two (VA-192, "Golden Dragons") assigned to Carrier Air Wing Eleven (CVW 11, code "NH"), aboard USS *Kitty Hawk*, 1971. The Navy "E" on each side of the fuselage below the cockpit is the prized award for Excellence in combat readiness. The curved directional arrows under the wingtips is a VA-192 humorous inversion of a "straight arrow" or "straight-shooting guy".

P. Endsleigh Castle, ARAeS

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Note: Unintentionally, port side view lacks detail outlines for the 20-mm M61 cannon bulge correctly included in underneath plan and head-on views. *Editor.*

Air Force way. Tail code letters show all three A-7D squadrons of the Myrtle Beach-based 354th Tactical Fighter Wing in close array. Tactical Air Command's badge is absent from middleman 355th's jet (AF70-971), flanked by MR, the 353rd's AF69-6240 and MN, the 356th's AF70-976. Camouflage patterns shows slight variations.
(Photo: US Air Force via Art Schoeni)

Navy way. "Shark's Mouth" deep-bellied photo-reconnaissance LTV (Vought) RF-8G Crusader—a reworked F8U-1P, later RF-8A—of Fighter-Photographic Squadron Sixty-Three basks in the Mediterranean sunshine in company with A-7B shipmates aboard USS Roosevelt. *Both are Carrier Air Wing Six (AE code) Corsair IIs of 1970 service period. Attack Squadron Fifteen's A-7B (BuNo. 154415) has pylon stores and drop tank but VA-215 Corsair II (BuNo. 154539) has no drop tank visible.*
(Photo: US Navy via Vought PR-9420)

38,800 feet with a drift-up to 43,400 before let down. A 20-minute loiter time at sea level at the destination is included. The corresponding ferry range is 1,945 nautical miles.

With four external fuel tanks, the initial cruise altitude is reduced to 29,350 feet and the final is 41,700 feet with retained tanks. Again, a 20-minute loiter time at the destination is included. The corresponding ferry range is 2,590 nmi.

In the USAF, 72 A-7D Corsair IIs make up each wing. The tables or organization call for 862 maintenance personnel to support each A-7D wing, based on a target figure of 45 flight hours per aircraft per month to establish maintenance workload requirements.

A-7D operational training began in September 1970. The first trainees—pilots from C Flight, 511th Tactical Fighter Squadron (later redesignated the 353rd TFS)—flew 37 hours per man out of Luke Air Force Base, Arizona. Phases II and III were conducted at the unit's home base, Myrtle Beach AFB, South Carolina, with the flying time of about 100 hours per pilot including air-to-ground gunnery, low-level navigation, in-flight refuelling, and air combat manoeuvres.

A-7D Phase I training later moved to Davis-Monthan AFB, Arizona, with the following phases done at the home base of each unit in training.

LATEST NAVAL VERSION

The A-7E benefits from the A-7D but has differences. Its Allison TF41, for example, is the -2 model, with a slight increase of take-off thrust to 15,000 pounds. Most of the Air Force changes were included in the USN's A-7E, plus a few special features in the avionics package that were peculiar to the Navy mission requirements.

A-7C was retrospective redesignation for first 67 A-7Es with A-7B-type P & W TF30-P-8 in place of later standard Allison TF-41-A-2. Rudder stencilled "13" checks with BuNo. 156746 serial as the 13th Blocks I-II A-7E built; but first to be flown (July 14, 1969) to service unit. Here, Commander Marvin Quaid, USN, ferries "13" from Dallas to NAS Lemoore, California, for the Corsair II permanent training squadron VA-122.

(Photo: Vought PR-9025)

The Navy's Mk. 12 cannon—used on the earlier A-7A/B—were replaced by a single M61 and 1,000 rounds of ammunition.

The A-7E fuel system is almost identical to that of the A-7D, but the internal volume is slightly greater because the Navy uses the foam liner only in the sump tank. Internal capacity is 1,496 US gallons (10,173 pounds of JP-5). The A-7E also can carry external fuel up to 1,200 gallons (8,160 pounds of JP-5) in four Aero 1D fuel tanks.

Other Naval features of the fuel system include the ability to refuel while the engine is running, and the retention of the probe-and-drogue system of in-flight refuelling.

Ordnance capability of the A-7E is similar to that of the D model but with the essential differences that the Navy version can carry some weapons the Air Force does not use (and vice versa), and the fuselage side mounts on the Navy version are each rated at 360 pounds load instead of the A-7D's 500 lb.

Reliability requirements specified a 78·2% probability of mission success, based on a 2·3-hour mission. Direct maintenance man-hours per flight hour were not to exceed 9·6.

Typical performance data shows a 4,300-ft. take-off distance on a 60°F. day at ■ gross weight of about 38,500 lb. with a load of 12 500-lb. Mk.82 general-purpose bombs on the wings. Other performance is directly comparable to that of the A-7D.

The Navy close-support mission assumes a loading of twelve Mk.82 bombs plus two AIM-9 Sidewinder missiles. With a mission profile generally similar to that specified by the Air Force, the A-7E can stay on station for 48 minutes at a combat radius of 300 nmi.

The Navy ferry mission assumes that two AIM-9 Sidewinders are carried for defence along with either internal or external fuel, and that the external fuel tanks —when used—are retained throughout the mission. A 900-lb. fuel reserve is specified at the destination. Under these conditions, the clean airplane ferry range is 1,599 nmi., and with external fuel, the ferry range is 2,430 nmi.

NAVIGATION AND WEAPONS DELIVERY

The A-7D and E models share almost identical navigation/weapons delivery systems. Their purpose is to navigate to the target, compute the run on the target and the weapon release, and then navigate to the home base.

Heart of the system is the IBM Corp. AN/ASN-91 (V) tactical computer, which receives input data from other subsystems of the avionics package and transforms that data into outputs which steer the airplane and drop weapons.

Inputs come from the position of the pilot's stick grip, the Singer General Precision AN/ASN-90 (V) inertial measurement set and AN/ASN-190 (V) Doppler radar, the Garrett Corp. CP-953A/AJQ air data computer, the angle-of-attack sensor, the armament release panel, the armament station control unit, the navigation data and control panel, and the Texas Instruments AN/APQ-126 (V) forward-looking radar.

Output data from the tactical computer commands the British Elliott Automation AN/AVQ-7 (V) head-up

Even ferry tanks are cheatlined on a brilliantly-adorned A-7E (BuNo. 156889) of the "Dambusters" (VA-195), in 1970 period deployed with Carrier Air Wing Eleven aboard USS Kitty Hawk. *The flight-deck identification numerals "00" (normally reserved for squadron commander's aircraft) incorporate white stars and "elevens" of the ancient game of craps. Pilot's tag below windshield inscribed "Lt. Jack Clark".* (Photo: Vought PR-9408)

P. Endsleigh Castle, ARAeS

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Key to colour illustration

LTV (Vought) A-7D Corsair II of the 356th Tactical Fighter Squadron ("Green Demons"), 354th Tactical Fighter Wing, Tactical Air Command, Myrtle Beach, South Carolina. Period, March 1972. Air Force Serial 70-942 is the 88th of the announced total of 387 A-7Ds ordered (see Table III on page 120). "Valor in Combat" is the motto of the 354th TFW; the shield appears on the starboard side of the fuselage behind the cockpit. AF70-942 is flown by the squadron commander, Lieutenant-Colonel Richard L. Wesbrook, USAF.

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display, the Computer Devices of Canada AN/ASU-99 projected map display and the pointing of the APQ-126 radar; it sends target data to the navigation data and control panel and release pulses to the armament control station.

The tactical computer takes the inputs and translates them into guidance commands for the pilot. In the target area, the computer sends steering data for display on the head-up unit and continuously computes weapon trajectories. Then it signals the release point for weapon drop, and switches to the return-navigation mode after all desired weapons have been released.

The computer makes it possible for the pilot to take any kind of evasive action or alternate approaches on the run into the target area; no longer does he have to make his delivery run along a straight-line path which can be so easily saturated with predictable anti-aircraft fire.

The inertial measurement set is the familiar unit which senses accelerations and integrates them into position indications. Combined with the tactical computer and the Doppler radar, which continuously measures ground speed and drift, the inertial set produces accurate navigational data.

The versatile forward-looking radar gives Air Force pilots nine, and Navy pilots ten, modes of operation. Two are ground-mapping modes, one from high altitude and the other from low. Terrain following, where the aircraft is flown at a preset altitude above the terrain, and terrain avoidance, where the aircraft is flown at a constant pressure altitude and is given information to avoid obstacles, are two more operational modes.

A cross-scan terrain avoidance mode combines those two features to permit flight either around or between protruding terrain at a preset altitude.

A cross-scan ground mapping mode shows both terrain-following commands combined with a ground map display.

Aiming instructions for the Mk. 1 Walleye TV-controlled glide bomb are presented in a TV mode.

For in-flight refuelling, there is a beacon mode which displays the range and bearing of the tanker aircraft for rendezvous.

The ninth mode is air-to-ground ranging, which gives slant range information to the tactical computer, and displays target lock-on and in-range signals.

The tenth mode, on the A-7E system only, provides signals for aiming the Shrike anti-radiation missile.

The air data computer takes all the temperature and pressure data pertinent to the flight path and translates them into airspeed and altitude signals. Its output goes to seven of the avionics components.

The head-up display (HUD) physically resembles an optical gunsight, mounted at the pilot's eye-level above the centre of the instrument panel. It combines optics and electronics to present, symbolically, aircraft performance and guidance data. It operates in navigation, attack and landing modes, plus a manual backup mode, and presents its data in the form of visible commands which the pilot steers toward. It also presents a pullup warning when the aircraft is in the attack, terrain-following, or landing modes, telling the pilot when to begin a 4 G pullup to avoid either an obstacle or the blast from an exploding weapon.

The projected map display set shows full-colour aeronautical charts on a small screen in a continuous display of the aircraft position. The maps can be in two scales: One in 2 million; or 1:500,000.

Maps for an entire theatre of operations can be stored in the unit, in addition to charts for emergency procedures, checklists, or instrument-approach plates.

Other elements of the system include the Bendix AN/APN-141 radar altimeter, the AN/ARN-52 Tacan airborne navigation system, the AN/APN-154 radar beacon, and an AQU-5A standby magnetic compass.

This complete avionics package gives the A-7 unique capabilities and has proven its reliability and effectiveness under combat conditions in the air war in Southeast Asia.

Simulation of flight conditions was a major factor in the development of the A-7 series, and the use of simulators continues through the programme.

One unit, developed to simulate the approach and landing, was used to train a group of Navy pilots for the first night carrier landings with the A-7E. Their later performance in carrier trials was compared to that of a similar group of pilots who had not received simulator training.

About 80% of the simulator-trained pilots caught the arresting gear on their first attempt; in marked contrast, the figure was less than 30% for pilots who had not practiced in the simulator.

Specific results from night carrier landings made by VA-174 pilots on the USS *Lexington* in June 1970 also show the advantages of simulator training. Almost 84% of the trained pilots boarded without any technique waveoffs by the Landing Signal Officer; the rate was 56% boardings for the group without simulator experience.

CORSAIR II IN COMBAT

The Navy calls the A-7 series '. . . the finest light attack weapon in the world.' An Air Force officer says the A-7D is a '. . . fighter pilot's dream . . . the F-86H (North American Sabre) with four hours' fuel and 10,000 pounds of bombs aboard.'

Behind those comments on the Corsair II is a remarkable operational record. In its first deployment, the A-7A was showing a daily availability of 10 to 12 Corsair IIs out of the 14-plane squadron. In its first 4,000 combat hours, not a single aircraft was lost in an operational accident. Its overall safety record is outstanding; in the first 50,000 flight hours, the Air Force had only three accidents with the A-7D.

The Navy, then with more than 47,000 combat sorties as data, said late in 1971 that 19 aircraft had been lost to enemy action during those missions. Of them, 16 were the early A/B models, and only three were the current advanced A-7E.

Aboard USS Saratoga *in the Mediterranean 1969-70. An A-7B (BuNo. 154527) of the "Stingers", VA-113 of (AC) Carrier Air Wing Three. Commander J. B. Streit, USN, on the catapult. Bridle bar extending forward of nosewheel leg is neater arrangement than older catapult strop method. Wing leading-edge fully depressed. Drop tank holds 300-US gallons.*

(Photo: Vought PR-9317)

Simply put, the A-7s have done about everything: Reconnaissance and strike missions, rescue and combat air patrol (Rescap), Fleet spotting, long-range reconnaissance, air-to-ground missile strikes, anti-SAM strikes, close air support and flak suppression. A-7s fitted with cameras for post-strike assessment have provided valuable supplementary coverage to the photo-reconnaissance flights by RF-8G Crusaders and RA-5C Vigilantes. Cleaned-up, the Air Force finds the A-7D to be a highly manoeuvrable low-altitude fighter.

The A-7A entered combat first with Navy Attack Squadron One Hundred Forty Seven (VA-147 "Argonauts") on December 4, 1967. Led by Commander James C. Hill, the squadron launched their first strike against bridges and highway targets around Vinh. The next few months were to see VA-147 based on the USS *Ranger*, fly and fight in some of the worst weather in Southeast Asia.

Four regular line periods were completed at *Yankee Station* in the Gulf of Tonkin, with strike missions flown north and south of the demilitarized zone (DMZ) and reconnaissance missions over Laos. After the USS *Pueblo* was seized by North Korean naval units in January 1968, the *Ranger* steamed into the Sea of Japan where the "Argonauts" flew patrols off the eastern coast of Korea in 20°F. weather conditions, a brutal contrast to the 90° F. days on *Yankee Station*.

Missions by VA-147 ran the gamut of the A-7As abilities. In December 1967, the squadron struck the Nui Long Lau tunnels near Thanh Hoa, using 500-, 1,000- and 2,000-lb. bombs to seal off the tunnel entrances. They hit bridges and shipping, railroads and vehicles, roads, oil and supply dumps in the area between Vinh and Haiphong.

The surface-to-air missile (SAM) sites and anti-aircraft batteries around the major cities of Cam Pha, Haiphong, Hanoi, Thanh Hoa and Vinh were hammered repeatedly by VA-147 aircraft.

During the siege of Khe Sanh, VA-147 flew air support for the Marine units in position.

Then after the Korean episode, VA-147 finished its tour on *Yankee Station* with hundreds of strikes against targets around Dong Hoa and Vinh, including a number of night strikes.

During their 1,400 combat sorties, VA-147 lost one aircraft to enemy action near Haiphong.

For early experience and exchange of ideas, the Navy and Air Force conducted *Coronet Stallion*, a joint project which assigned three USAF pilots, one maintenance officer and 20 enlisted specialists to VA-147 on the USS *Ranger* during that first deployment.

The USAF pilots logged about 1,200 hours in the A-7A during their 18 months at sea, averaging about 65 combat missions and 125 carrier landings for each man. The USAF team chief, Major Charles McClarren, summarized the experience in these words:

"... we found the A-7A a very rugged, stable and long-legged aircraft. Performance was not impressive with the small engine (TF30), but fuel economy was astounding. We rarely flew with a full internal fuel load during training, since there was no need for it. Six thousand pounds of fuel would normally give us 1 + 45 to 2 + 00 hours flying time. The full load gave us a 3-hour plus capability, with a 2,100 nautical mile range.

"Our standard Alpha (A-7A) strike configuration was four Mk. 84 bombs and in other missions we carried twelve Mk. 82 high drag bombs as a standard load. In any of these configurations, we could go out 350 nautical miles, stay on station 30 minutes and return to the ship with a one-hour fuel reserve. We decided that external tanks were more trouble than they were worth because of reconfiguration problems, and with three hours available on internal fuel, who needed them?

"Our maintenance people thought the A-7A one of the most easily maintained aircraft that they had encountered. We had 14 aircraft and kept 12 airborne most of the time while flying an average of 30 to 36 sorties per day.

"The A-7A contract guarantee of 11·5 Direct Maintenance Manhours per Flight Hour (DMMH) was met

Carrier suitability testing of the A-7E included a series of catapult launches from USS Independence. *As depicted—with black-and-white test markings—this A-7E mounts a total weight of stores in excess of 19,000 lb.; including 20 dummy Snakeye Mk. 80-series, retarded-fall bombs, two AGM-45 Shrike missiles and two 300-US gal. drop tanks. Jet blast barriers are raised for catapult sequence.*

(Photo: Vought PR-9110)

during our operations, and we feel that the A-7D guarantee of 9·5 DMMH will also be met after it gets into operation, in spite of the increased system complexity.'

Two more A-7 units—VA-82 (Marauders) and VA-86 (Sidewinders)—were deployed in April 1968 and arrived at *Yankee Station* on May 30. They flew their first combat strikes the next day off the USS *America* and lost two aircraft to enemy fire. Both pilots were rescued, one after 180 Rescap sorties were flown to locate and recover him. He was picked up after 39 hours on the ground in hostile country.

The USS *Constellation*, with VA-27 (Royal Maces) and VA-97 (War Hawks) squadrons aboard, joined the *America* on *Yankee Station* in July 1968, following the relief of VA-147 in May. The two squadrons flew *Rolling Thunder* strike missions against North Viet Nan, and *Steel Tiger* reconnaissance flights over Laos.

For the rest of 1968, the four squadrons on the USS *America* and the USS *Constellation* were racking up combat experience that could be compared directly with that of A-4 Skyhawks on other carriers in the Gulf.

All four A-7A squadrons joined in heavy attacks against the North Viet Nam radar net in July 1968.

The first A-7B squadrons, VA-25 (Fist of the Fleet) and VA-87 (Golden Warriors), sailed on the USS *Ticonderoga* late in 1968. They demonstrated a unique advantage of the Corsair II: Its ability to operate from any class of attack carrier in commission. The *Ticonderoga*, commissioned in 1944 under the pressures of wartime production, now is one of the smaller fleet carriers and has only simple support facilities for her aircraft. But the two A-7B squadrons operated from her in combat strikes from *Yankee Station*, with no restrictions imposed by the ship's size or capabilities.

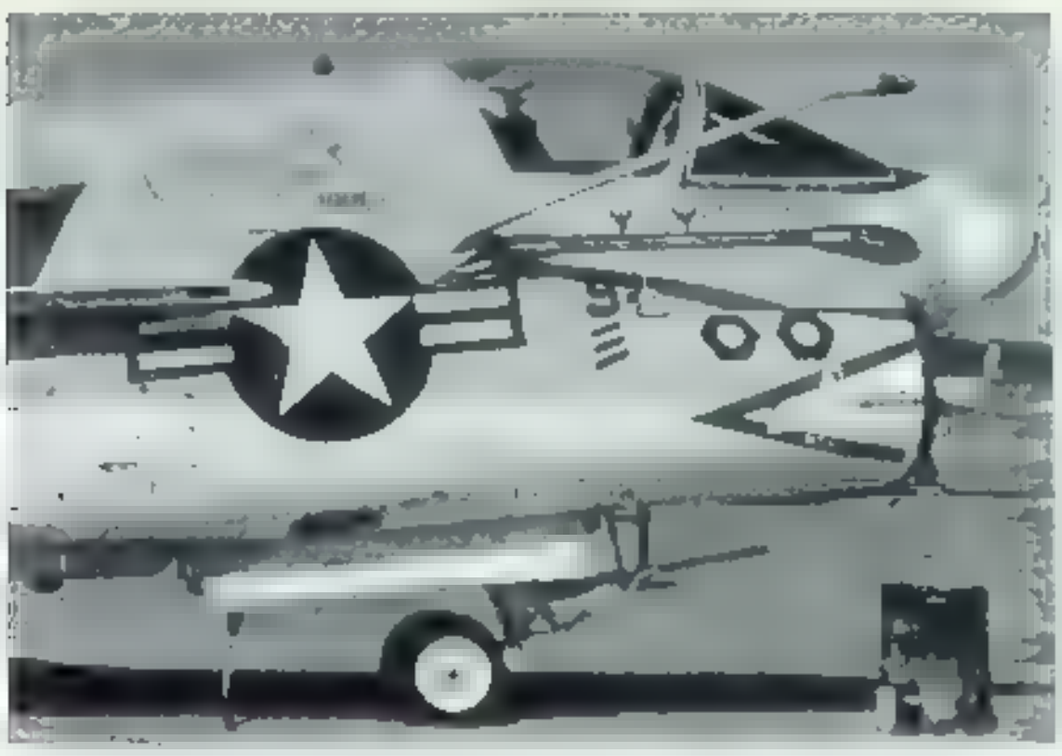
Yankee Station experience showed both range and endurance qualities of the Corsair II. Aerial refuelling was not routinely required on long-range missions, or on return to the ship and a delayed landing.

The arrival of the A-7E in Southeast Asia, with its advanced navigation and weapons delivery system, scored a major improvement in combat efficiency. Pilots using the system were able to place more bombs more accurately, either automatically or in the manual mode, through the use of the new system.

Night missions against targets on the Ho Chi Minh

Another black-and-white, test-marked Corsair II, this time the 15th A-7A (BuNo. 152658) undergoing company catapult trials at the historic Naval Air Station Lakehurst (remember Dirigibles and Blimps?), New Jersey. Vought Experimental Test Pilot H. L. New's A-7A is being readied with heaviest-ever load of bombs and rockets of 19,940 lb. to gross take-off weight approaching 42,000 lb.

(Photo: Vought PR-8981)



Seldom illustrated in extended position is the refuelling probe: here on A-7E (BuNo. 156822) of VA-192 ("Golden Dragons"). Double-0 is inscribed "Cdr. J. B. O'Hara"; Commander of CVW-11 aboard USS Kitty Hawk. *Three-bar "S" is unit's three annual Safety awards and "E" is for Excellence in combat readiness and other Fleet outstanding achievements.* (Photo: Vought via Art Schoeni)

Trail have underlined the effectiveness of the system, even under conditions for which it was not primarily designed. One USAF officer flying as an exchange pilot with a Navy unit equipped with A-7Es said he felt confident he could give close support to ground troops within 50 metres while strafing, 50 to 75 metres with high-drag bombs, and 100 metres using low-drag bombs.

Excerpts from official Navy combat reports emphasize the major features of the A-7E. From the USS *America:* 'Pilots say A-7E finest attack aircraft in Navy's inventory. Forward air controllers say it's the best aircraft in the Far East—pinpoint accuracy.'

From the USS *Ranger:* 'Forward air controllers report CEP* 27·4 metres, 91 per cent full systems operational, availability exceptional.'

From USS *Kitty Hawk:* 'The M61 gun truly proves its worth, rendered several tanks immobile. Forward air controller moves A-7E closer to "friendlies" than any other aircraft.'

From USS *Forrestal:* 'M61 gun continues to impress pilots.'

*CEP is defined as the radius of a circle within which 50% of the hits occur and is, correctly, Circular Error Probable.

More recent summaries are not available, but a December 1969 Navy report showed that 80 million pounds of ordnance had been dropped by A-7 aircraft in their first two years of combat experience. In that time, the Corsair IIs logged 40,000 combat flight hours on 20,000 sorties.

Air Force experience has been limited to training with the A-7D, although early deployment to a combat zone was expected in the spring of 1972. The contract cost estimate for the A-7D programme was missed by only about 4%—yet the aircraft has exceeded guaranteed performance in many critical areas. While only about 1% faster with full load than the guaranteed speed, the A-7D has 11% more time available on station than was promised. It is 10% under the take-off-distance guarantees and 26% under the landing-distance guarantees. The ferry range was exceeded by 5%.

Bomb scores are running 20% better than the requirements, and gun accuracy is 50% better.

The navigation system was guaranteed not to drift more than two nautical miles per hour; the system is performing with drift rates between 1·6 and 1·8 nmi. per hour.

The war in Southeast Asia is an unpopular one. Its air way is directed against ground targets, with little air-to-air combat and few of the individual pilot-heroes who have characterized earlier wars.

Its true heroes fly aircraft like the A-7 into hotly defended areas daily, to strike targets which too often are of doubtful military value, and too often not worth the risk of pilot and aircraft.

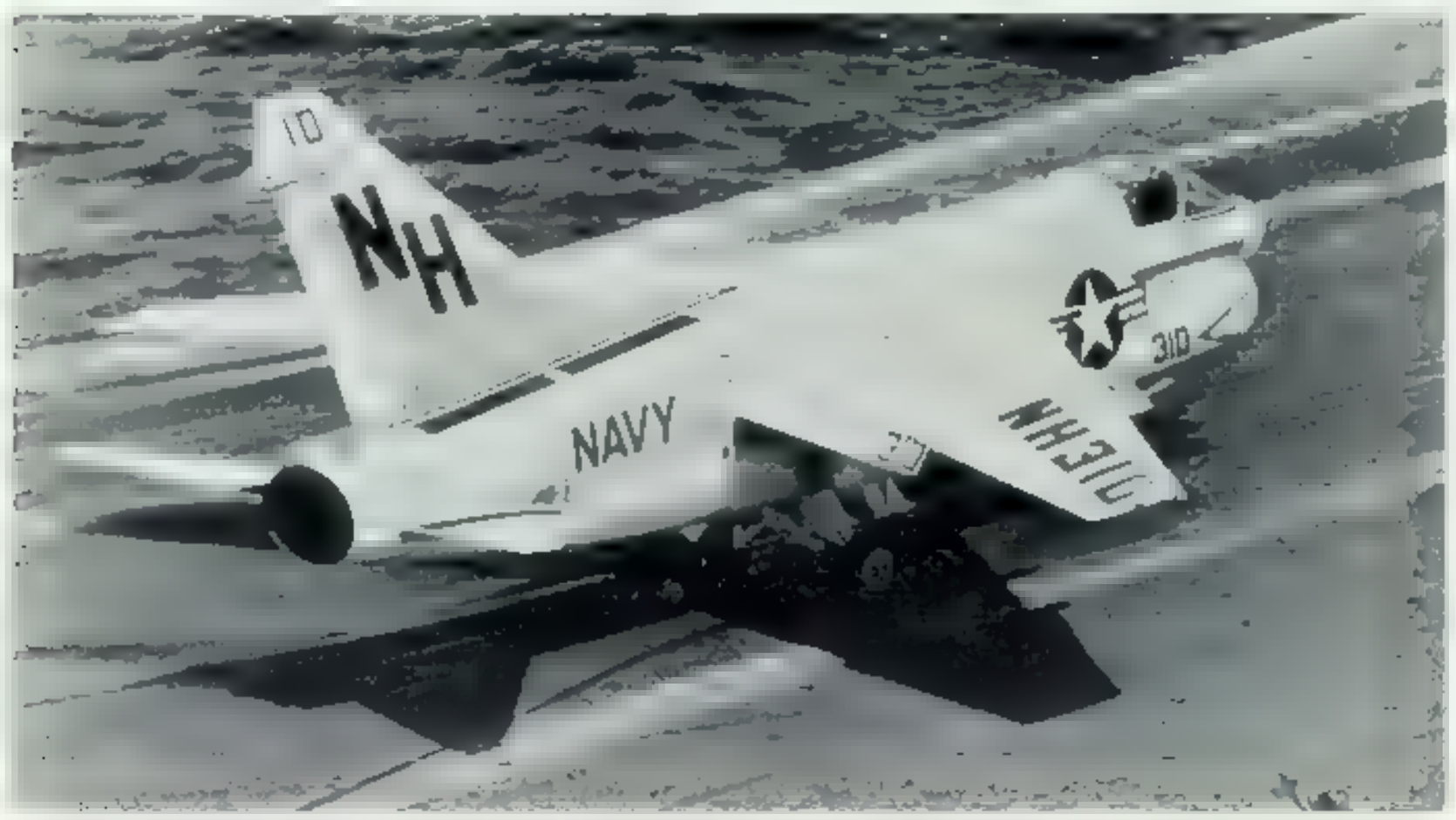
In such a combat environment, a highly automated, sophisticated jet aircraft like the A-7 has the best chance of survival and of bringing the pilot safely back to base. The combat reports and the extremely low loss rates bear this out.

'I think history will show that we should never have been over here,' said one pilot. 'But we're doing a damn good job of the dirty job we've got to do.'

And the Vought A-7 Corsair II appears to be the right kind of aircraft for that "damn good job".

CORSAIR II POWERPLANT DEVELOPMENT

Navy officials planning the VAL wanted to get the best weapon system at the lowest cost. With a major



VA-192 "Golden Dragons" again. An A-7E (BuNo. 157537) has just released arrester-wire after landing on USS Kitty Hawk *in 1971 after combat strike over Viet Nam.*
(Photo: US Navy 10,004-71)

Woosh! Polka-dot markings on existing AGM-65A Maverick TV-guided air-to-ground missile and similar black-and-white markings on fuselage of second evaluation A-7D (AF67-14583) are for photo assessment of the firing. This USAF programme was conducted at the Air Proving Ground Centre, Eglin AFB, Florida. (Photo: USAF)

portion of that cost inevitably tied to the price of the engine, the first choice was naturally a powerplant which had been developed and was in production.

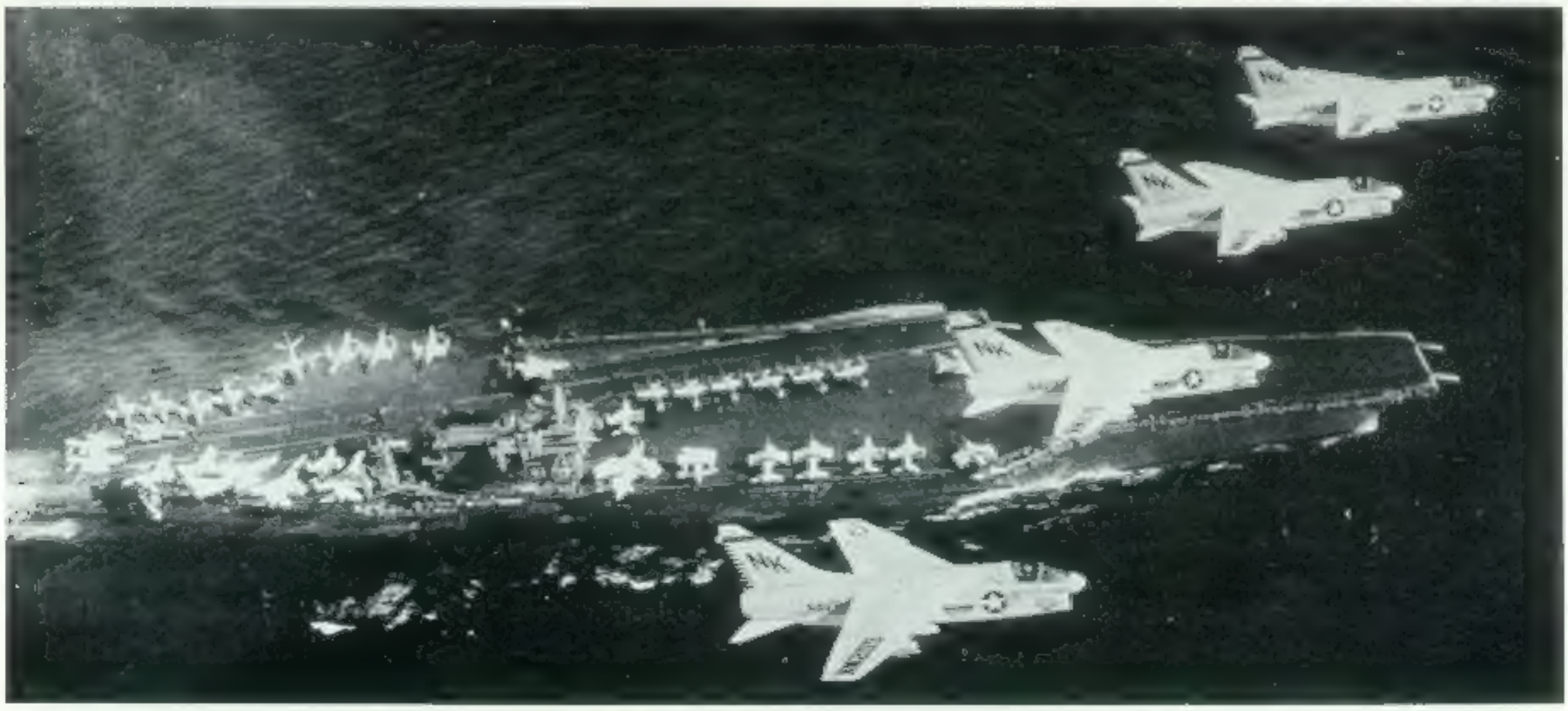
The Pratt & Whitney TF30-P-6 turbofan was chosen for the A-7A. The basic engine had been developed for the General Dynamics/Grumman F-111 programme, and most of the research and development costs had been written off on that programme. The Navy did not need the afterburner of the F-111 engine, and specified the -6 version without one.

The A-7B used the TF-30-P-8, essentially the same engine but with the take-off thrust increased from the 11,350 pounds of the -6 to 12,200 lb. static thrust. Production changes later incorporated in the A-7B airframe made provision for an uprated version of the TF30, which was designated TF30-P-408 and was rated at 13,400 lb. for take-off.

Plans were to continue using the -8 engines in production A-7E aircraft, and the first 67 were fitted with the P & W powerplant. But Pratt & Whitney was having production problems with the engine, causing schedule slippages early in 1968 and delaying delivery of A-7Bs to the Navy.

At about the time the Air Force seriously began to look at the A-7 series, there were mounting pressures—technical and political—to change to another engine. The USAF, after determining runway requirements for a fully-loaded A-7 in the hot-weather environment of Southeast Asia, decided to go for an afterburning engine and its increased thrust. Defence Secretary Robert S. McNamara was being pressed to buy British aeronautical material as offset purchase to compensate the British for ordering the F-111 fighter. And Pratt & Whitney, with a large commercial engine backlog and heavy prior com-

A-7As of VA-27 ("Royal Maces") of CVW-14 (NK) deployed on USS Constellation *photographed in the Gulf of Tonkin in 1968. Aft end of angled deck shows F-4 Phantoms awaiting turn for catapulting; one is already in the slot. Other "hardware" visible include A-3 Skywarriors, A-5 Vigilantes and A-6 Intruders.* (Photo: USN via Vought PR-8798)



Temporary A-7G configuration—to meet original Swiss Air Force requirements— was achieved by reworking a standard A-7D. Shown here is one of the loads offered for export, ten 1,000-lb. bombs and two AIM-9 Sidewinders. On April 11, 1972, a second "Swiss reconfigured" A-7D left Dallas Naval Air Station for the SwAF base at Emmen for several weeks' evaluation.
(Photo: Vought)

mitments for TF30 production, told the Air Force that afterburning engines could not be delivered any sooner than 37 months after the receipt of a contract.

The result was that the Allison Division of the General Motors Corp. was selected to develop and build the RB.168-62 Spey 25 engine in a joint programme with Rolls-Royce Ltd. The engine was projected to have a thrust of 14,250 lb.—just enough over that of the TF30 to negate the USAF requirement for an afterburner. The developed Spey also was expected to cost about 20 to 25% less than an after-burning version of the TF30.

In June 1966, Allison and Rolls-Royce submitted the formal proposal for the TF41 engine programme, and it was accepted by both the Air Force and the Navy to be the powerplant for the next two models of the Corsair II —the A-7D and E.

The programme was a short one, calling for parallel development and production in order to meet the required schedule for delivery of production engines two years after the date of the contract.

First of the contracts (No. F33657-67-C-0163) was signed on October 21, 1966. It covered the development and production of 332 engines for the A-7D and 413 for the A-7E. Value of the contract was over $300 million.

Allison later received a second contract (No. F33657-70-C-1088) in excess of $50 million, for an additional 84 engines for the A-7D and 11 for the E.

The first production engine was delivered in July 1968, ahead of schedule.

Detail changes to convert the Spey to the TF41 included completely new low- and intermediate-pressure-ratio compressor stages, dual fuel pumps, and higher turbine inlet temperatures.

There also were differences between the -1 version for the Air Force and the -2 for the Navy. First, the two services burn different grades of jet fuel: JP-4 for the USAF and JP-5 for the Navy. The specified oil types were different. The Navy required a fuel heater but the Air Force did not.

In addition to the thrust differences between the two engines, there were also small differences in compression ratios and bypass ratios, and the Navy engine was heavier.

Engine stability under operational conditions was demonstrated in a number of ways by Allison. Catapult tests, during which the A-7 was launched 72 times by steam catapult, showed no indication of engine surge or stall from steam ingestion. This had caused problems with the earlier A-7As and their TF30 engines, cured with engine handling techniques.

Cannon, rockets and missiles were fired during flight tests to determine their effects on engine inlet conditions and operations. Reports indicated there were no problems there either.

Allison also ran a series of engine tests with an afterburner, even though none was required for the engine. The aim was to check compatibility of the engine-afterburner combination and also to check its ability to continue running stably in the presence of large pressure pulses from afterburner ignition and shutdown. Both aims were achieved.

Prototype A-7D (AF67-14582) shows off biggest-yet bombs (4 × 3,000-lb.) carried by Air Force Corsair IIs; but not heaviest total load.
(Photo: Vought PR-9401)



Test models of Corsair IIs (left) *for spin tunnel at NASA's Langley (Virginia) Research Centre and* (right) *for the USAF's Arnold (Tennessee) Engineering Development Centre where the contractor, ARO, Inc. developed the required computer-checked, stores' separation simulation techniques.* (centre) *Navy A-7B production at Vought Aeronautics, Dallas, Texas.*
(Photos: USAF and Vought)

TABLE I: CORSAIR II CHRONOLOGY

1963:	May	Navy's Sea Based Air Strike Study completed, defining general requirements for new attack aircraft.
	June	Industry design proposal begun.
1964:	Feb. 11	LTV declared winner of VAL competition.
	Mar. 19	Firm, fixed-price contract negotiated.
	June 25	Full-scale mock-up evaluated.
1965:	Jan. 15	Engineering design completed.
	Sept. 27	First A-7A flight.
1966:	Jan. 10	First Navy preliminary evaluation.
	Sept. 13	Board of Inspection Survey (BIS) trials begin at NATC Patuxent River.
	Oct. 14	First A-7A delivered to fleet squadron VA-174 at NAS Cecil Field.
	Nov. 15	First A-7A carrier trials aboard USS *America*.
1967:	Sept. 11	First A-7A with fleet-deployment modifications delivered to VA-147.
	Nov. 4	VA-147, first operational A-7A squadron, deployed aboard USS *Ranger*.
	Dec. 3	First A-7A combat action.
1968:	Feb. 6	First A-7B flight.
	April 6	First A-7D flight.
	April 25	BIS trials begin for A-7B at NATC Patuxent River.
	May 25	VA-147 returned from Viet Nan duty.
	Sept. 26	First A-7D flight with Allison TF41 engine installed.
	Nov. 25	First A-7E flight.
1969:	Jan. 6	First deployment aboard USS *Enterprise*—A-7Bs of VA-215 and VA-146.
	Mar. 4	First A-7B combat action.
	June 13	BIS trials begin for A-7E.
	June 30	First delivery of A-7D to USAF to begin climatic testing.
	July 14	First A-7E delivery to fleet squadron VA-122, NAS Lemoore.
	Sept. 1	First delivery of A-7D to USAF for TAC 4510th Combat Crew Training Wing, Luke AFB.
1970:	Jan. 15	VA-146 and VA-147, first operational A-7E squadrons, deployed aboard USS *America*.
	May 23	First A-7E combat action.
	Sept. 17	First A-7D delivered to USAF operation squadron, the 511th Tactical Fighter Squadron at Myrtle Beach AFB.
1971:	April 5	First A-7A assigned to reserve squadron, VA-303, NAS Alameda.
	July	First A-7D wing, the 354th Tactical Fighter Wing, completely equipped.

SPECIFICATIONS: CORSAIR II (All models unless noted)

Dimensions: Wingspan 38·73 ft.; folded span 23·77 ft.; overall length 46·13/46·75 ft. (A); 46·75 ft. (B); 45·60 ft. (D & E); height, three-point 16·08 ft.

Weights: Empty 15,037 lb. (A); 19,258 lb. (D); 18,546 lb. (E); take-off, ferry mission, with full external fuel 38,991 lb. (D); 37,300 lb. (E); take-off, close-support mission 37,456 lb. (D); 38,500 lb. (E).

Powerplant and maximum rated thrust: TF30-P-6, 11,350 lb. (A); TF30-P-8, 12,200 lb. (B); TF30-P-408, 13,400 lb. (B); TF41-A-1, 14,500 lb. (D); TF41-A-2, 15,000 lb. (E).

Fuel system capacity (US gallons): Internal fuel 1,496 gal. (A, B & E); 1,425 gal. (D); external fuel 1,200 gal.; total fuel weight 18,333 lb. (A, B & E); 17,063 lb. (D).

Communications equipment: ARC-51 UHF transceiver; ARR-69 emergency UHF receiver; ARA-50 UHF/ADF; APX-64 IFF receiver/transmitter (A & B); APX-72 IFF receiver/transmitter (D & E); ASW-25 data link (A, B & E); AIC-26 intercom (D); AIC-25 intercom (E); FM-622A VHF receiver/transmitter (D & E); Juliet 28 voice scrambler.

Navigation and weapon delivery system (A & B): APN-153 Doppler radar; ASN-41 navigational computer; ASN-50 all-altitude reference; APN-141 radar altimeter; ARN-52 Tacan; APQ-116 forward-looking radar; TPQ-10 tracking radar; APN-154 radar beacon; ARW-77 Bullpup command unit; CP-741 weapons delivery computer.

Navigation and weapon delivery system (D & E): ASN-91 tactical computer; ASM-90 inertial measurement set; APN-190 Doppler radar; APQ-126 forward-looking radar; CP-953/AJQ air data computer; AVQ-7 head-up display; ASN-99 projected map display; APN-141 radar altimeter; APN-154 radar beacon; ARN-52 Tacan; AQU-5/A standby magnetic compass; ARN-58A ILS; CPU-80 flight director computer; ARW-77 Bullpup command unit; provisions for ARN-92 Loran.

Electronics countermeasures equipment (D & E): APR-36 radar threat warning; APR-37 SAM launch warning; ALQ-100 multiple-band track breaker.

	A-7A	A-7B	A-7D	A-7E
Powerplant	TF30-P-6	TF30-P-8	TF41-A-1	TF41-A-2
Rated thrust (lb.)	11,350	12,200	14,500	15,000
Specific fuel consumption (lb./hr./lb.)	0·62	0·63	0·847	0·864
Compression ratio	17·1:1	19·1:1	21:1	21·4:1
Bypass ratio	—	—	0·76:1	0·74:1
Length (in.)	128·0	128·0	114·2	114·2
Diameter (in.)	42·0	42·0	39·5	39·5
Weight (lb.)	2,716	2,526	3,175	3,256

TABLE II: CORSAIR II WEAPONS

Ordnance and external stores carried by the Corsair II include these A-Z examples:

Air-to-air missiles: AIM-9 Sidewinder.
Air-to-ground missiles: AGM-12A and B Bullpup; AGM-65A Maverick; Shrike anti-radiation missile; Mk. 1 Walleye TV-guided glide bomb.
Bomblet dispensers and cluster bombs.
Bombs (general-purpose): 250-lb. Mk. 81; 500-lb. Mk. 82; 750-lb. M117A1.
Chemical/biological weapons.
Electronic countermeasures pods.
Eye-series weapons: Gladeye (1,000-lb.) cluster bomb; Rockeye shaped-charge bomblets; Sadeye (750-lb.) low-drag cluster bomb; Snakeye Mk. 80 series retarded-fall bomb; Weteye.
Fire bombs: BLU-1C/B napalm tanks.
Flare dispensers: SUU-42/A parachute flares.
Fuel tanks: Aero 1D 300-gallon tanks.
Gun pods.
Leaflet dispensers.
Naval mines: CBU-34A/A mine dispenser.
Nuclear weapons.
Refuelling stores and tow target pod.
Rocket launchers: LAU-3A; 5-in. Zuni pods.
Spray/smoke dispensers.

TABLE III: CORSAIR II CONTRACT SUMMARY

A-7A (199 aircraft)—Contract NOw64-0363f

Block	Serial Numbers	Quantity
I	152580 through 152582	3
II	152647 through 152650	4
IIIa	152651 through 152660	10
IIIb	152661 through 152685	25
IVa	153134 through 153181	[illegible]
IVb	153182 through 153233	52
IVc	153234 through 153273; 154344 through 154360	57

A-7B (196 aircraft)—Contract N00019-67-C-0082

Block	Serial Numbers	Quantity
I	154361 through 154417	57
II	154418 through 154474	57
III	154475 through 154522	48
IV	154523 through 154556	34

A-7D (387 aircraft)—Contract N00019-67-C-0143

Block	Serial Numbers	Quantity
I	AF67-14582 through AF67-14586; AF68-8220	6
II	AF68-8221 through AF68-8224	4
III	AF68-8225 through AF68-8231; AF69-6188 through AF69-6196	18
IV	AF69-6197 through AF69-6207	11
V	AF69-6208 through AF69-6220	13
VI	AF69-6221 through AF69-6244	24
	Contract N00019-70-C-0497	
VII	AF70-929 through AF70-968	40
VIII	AF70-969 through AF70-1012	44
IX	AF70-1013 through AF70-1056	44
	Contract N00019-71-C-0470	
X	AF71-0292 through AF71-0335	44
XI	AF71-0336 through AF71-0379	44
XII	AF72-169 through AF72-217	49
XIII	AF72-218 through AF72-265	48

A-7E (398 aircraft)—Contract N00019-68-C-0075

Block	Serial Numbers	Quantity
I*	156734 through 156740	7
II*	156741 through 156761	21
III*	156762 through 156800	39
IV	156801 through 156840	40
V	156841 through 156890	50
VI	157435 through 157481	47
VII	157482 through 157537	56
VIII	157538 through 157594	[illegible]
	Contract N00019-70-C-0497	
IX	158002 through 158028	27
X	158652 through 158666	15
XI	158667 through 158681	15
	Contract N00019-71-C-0470	
XII	158819 through 158830	12
XIII	158831 through 158842	[illegible]

*Blocks I, II and III later Navy redesignated as A-7C

TABLE IV: CORSAIR II USER SQUADRONS

A-7 Attack Squadrons, U.S. Navy

VA-12 *Kiss of Death**	VA-94 *Shrikes*
VA-15 *Valions*	VA-97 *War Hawks*
VA-22 *Fighting Redcocks*	VA-105 *Gunslingers*
VA-25 *Fist of the Fleet*	VA-113 *Stingers*
VA-27 *Royal Maces*	VA-122 *Corsair College***
VA-37 *Bulls*	VA-125 *Rough Raiders*
VA-46 *Clansmen*	VA-146 *Blue Diamonds*
VA-56 *Champions*	VA-147 *Argonauts*
VA-66 *Mod Squad*	VA-153 *Blue Tail Flies*
VA-72 *Blue Hawks*	VA-155 *Silver Foxes*
VA-81 *Sunliners*	VA-174 *Hell Razors*
VA-82 *Marauders*	VA-192 *Golden Dragons*
VA-83 *Rampagers*	VA-195 *Dambusters*
VA-86 *Sidewinders*	VA-215 *Barn Owls*
VA-87 *Golden Warriors*	VA-303 *Golden Hawks*
VA-93 *Blue Blazers*	VA-304 *Fire Birds*

*Alias the "Flying Ubangis".

**To distinguish training of A-7E pilots and maintenance crews from operations of earlier Corsair II models, the NAS Lemoore, California, training squadron has name-changed (1972) to the "Flying Eagles".

A-7 Tactical Fighter Squadrons, U.S. Air Force

354th Tactical Fighter Wing:
- 353rd Tactical Fighter Squadron *Black Panthers*
- 355th Tactical Fighter Squadron *Fighting Falcons*
- 356th Tactical Fighter Squadron *Green Demons*

355th Tactical Fighter Wing:
- 354th Tactical Fighter Squadron *Fighting Bulldogs*
- 357th Tactical Fighter Squadron *Licking Dragons*
- 40th Tactical Fighter Squadron *Satans*
- 333rd Tactical Fighter Training Squadron *Lancers*

18th Tactical Fighter Wing:
- 44th Tactical Fighter Squadron
- 67th Tactical Fighter Squadron

*The 18th TFW operates F-4s and F-105s from Kadena Air Base, Okinawa. Re-equipment with A-7Ds was announced at time of writing (March 1972). The third unit in this Wing, the 12th TFW, will retain its Republic F-105F Thunderchiefs for special missions.

SERIES Editor: CHARLES W. CAIN

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Outward-bound from San Diego to the South China Sea and Viet Nam in early 1969, USS Ticonderoga *provides a shopwindow for the hardware of Carrier Air Wing Sixteen (code AH). On the flight deck are A-7B Corsair IIs of VA-25 ("Fist of the Fleet") and VA-87 ("Golden Warriors"). Other LTV products ranged on deck are VF-111 and VF-162 F-8E Crusaders and VFP-62 RF-8G Crusaders. Two distinctive "mushroom-headed" Grumman E-1B Tracers and several delta-wing McDonnell Douglas A-4E Skyhawks may also be seen.*
(Photo: US Navy)